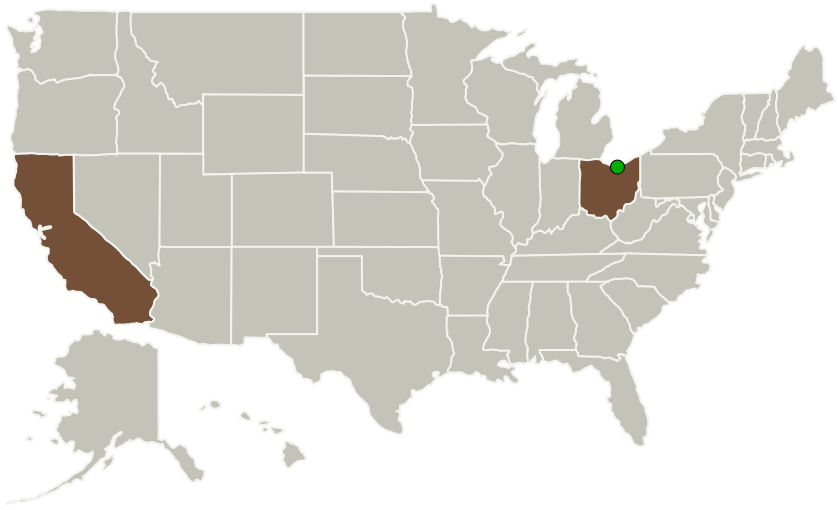
# Harsh Environment Gas Sensor Array for Venus Atmospheric Measurements, Phase II

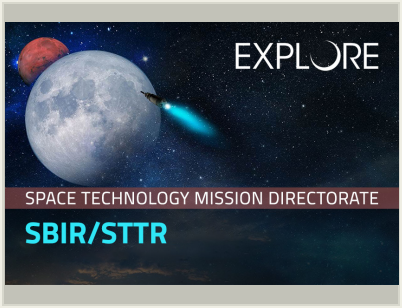
Completed Technology Project (2013 - 2015)

## Project Introduction

Makel Engineering and the Ohio State University propose to develop a harsh environment tolerant gas sensor array for atmospheric analysis in future Venus missions. The proposed instrument will be very compact, require low power, and ruggedly packaged to be compatible with a drop sonde payload from a balloon for atmospheric composition analysis and/or for use on Venus surface lander or surface weather station. The goal is to provide information on local SOx CO, O2, NOx, H2, OCS, HF, HCl, and water vapor concentrations in order to complement other measurement systems that were targeted in the 2009 Venus Flagship Mission Study such as a GC-MS, nephelometer, or camera/optical detectors. Phase II will fabricate and test probe designs based on sensors tested in Phase I. Complete sensor array including high temperature capable electronics (250 to 300 C) will be tested at the NASA Glenn Extreme Environment Rig (GEER) to provide simulation of the Venus atmosphere at different conditions.

## Primary U.S. Work Locations and Key Partners



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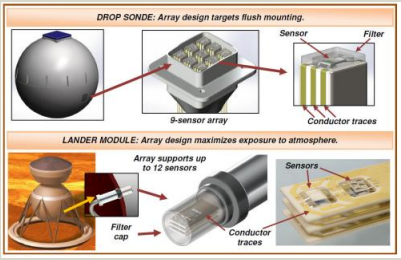
| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Makel Engineering, Inc. | Lead Organization | Industry<br>Small Disadvantaged Business (SDB) | Chico, California |
| Glenn Research Center(GRC) | Supporting Organization | NASA Center | Cleveland, Ohio |

| Primary U.S. Work Locations | |
|---|---|
| California | Ohio |

## Images




**Briefing Chart**
Harsh Environment Gas Sensor Array for Venus Atmospheric Measurements, Phase II
*(https://techport.nasa.gov/image/130031)*

## Organizational Responsibility

**Responsible Mission Directorate:**
Space Technology Mission Directorate (STMD)

**Lead Organization:**
Makel Engineering, Inc.

**Responsible Program:**
Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**
Jason L Kessler

**Program Manager:**
Carlos Torrez

**Principal Investigator:**
Darby B Makel

**Co-Investigator:**
Darby Makel

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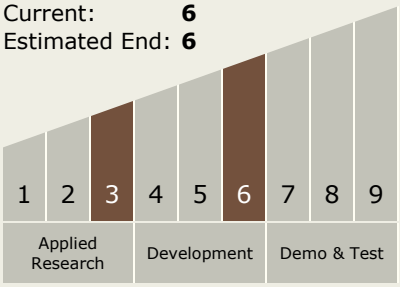
## Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**




## Technology Areas

**Primary:**

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.4 Environment Sensors

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System